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Nonminimal Einstein-Maxwell-vlasov-axion model

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Abstract

We establish a new self-consistent system of equations accounting for a nonminimal coupling of the cooperative gravitational, electromagnetic and pseudoscalar (axion) fields in a multi-component relativistic plasma. The axionic extension of the nonminimal Einstein-Maxwell-Vlasov theory is based on two consistent procedures. First, we use the Lagrange formalism to obtain nonminimal equations for the gravitational, electromagnetic and pseudoscalar fields with the additional sources generated in plasma. Second, we use the Vlasov version of the relativistic kinetic theory of the plasma, guided by the cooperative macroscopic electromagnetic, gravitational and axionic fields, to describe adequately the response of the plasma on the variations of these fields. In order to show the self-consistency of this approach we check directly the compatibility conditions for the master equations for the cooperative fields. Using these compatibility conditions we reconstruct the ponderomotive force, which acts on the plasma particles, and discuss the necessary conditions for existence of the distribution function of the equilibrium type. © 2014 IOP Publishing Ltd.

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Keywords

axion field, nonminimal coupling, relativistic plasma, Vlasovmodel